299-E33-11 (A6854)

Log Data Report

Borehole Information:

Borehole: 299-E33-11 (A6854)			**Site:** Northeast of 216-B-8 Crib		
Coordinates (WA State Plane)		**GWL (ft)[1]:** 221.9		**GWL Date:** 02/05/02	
North	**East**	**Drill Date**	**TOC[2] Elevation**	**Total Depth (ft)**	**Type**
137,636 m	573,901 m	Jan. 1954	620.3 ft	230	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel Welded	2.0	8.625	8.0	0.3125	0	229

Borehole Notes:

The logging engineer measured the pipe stickup at the borehole using a steel tape. Calipers were used to measure casing outside diameter and thickness. The height of reference point (TOC) was measured at 2.0 ft above ground surface by the logging engineer and not at 2.6 ft as reported on the as-built drawing (Ledgerwood 1993). Casing stick-up is missing all survey "X's." Top of casing stickup is cut irregularly. On 02/05/02, the borehole was swabbed and no contamination was detected. The Duratek Federal Services well service crew measured groundwater depth and total depth. The TOC elevation and casing bottom (TOC reference) are reported from information provided in Chamness and Merz (1993). The coordinates stated above are from HWIS[3].

Logging Equipment Information:

Logging System:	Gamma 2B		**Type:** SGLS (35%)
Calibration Date:	11/01	**Calibration Reference:**	GJO-2002-287-TAR
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	Repeat
Date	02/05/02	02/06/02	02/07/02	02/08/02	02/08/02
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	2.0	53.5	227.5	159.0	201.0
Finish Depth (ft)	54.5	160.0	171.0	172.0	224.0
Count Time (sec)	100	100	100	100	100
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	0.5	0.5	0.5	0.5	0.5
ft/min	N/A[4]	N/A	N/A	N/A	N/A
Pre-Verification	B0076CAB	B0078CAB	B0079CAB	B0080CAB	B0080CAB
Start File	B0077000	B0078000	B0079000	B0080000	B0080027
Finish File	B0077105	B0078213	B0079113	B0080026	B0080073

Log Run	1	2	3	4	Repeat
Post-Verification	B0077CAA	B0078CAA	B0079CAA	B0080CAA	B0080CAA
Depth Return Error (in.)	0	+1.25	+1.5	0	0
Comments	No fine-gain adjustments made.	Fine-gain adjustment notes below.	Fine-gain adjustment notes below.	No fine-gain adjustments made.	No fine-gain adjustments made.

Logging Operation Notes:

Zero reference is the top of casing.

Pre- and post-survey verification measurements used the Amersham KUT verifier with serial number 082.

Logging was performed with a centralizer installed on the sonde. During logging run 2, 02/06/02, fine-gain adjustments were made after files B0078057, -108, and -184. During logging run 3, 02/07/02, a plastic bag enclosed the sonde, and fine-gain adjustments were made after files B0079002, -008, and -012. ^{60}Co was detected from 214 ft through total depth.

Analysis Notes:

Analyst:	Sobczyk	Date:	02/25/02	Reference:	MAC-VZCP 1.7.9, Rev. 2

Pre-run and post-run verification spectra were collected at the beginning and end of each day. The recorded peak counts per second (cps) for the 609-keV peak, 1461-keV peak, and 2615-keV peak were consistently lower each day in the post-run verification as compared to the pre-run verification. These changes varied from 5 to 12 percent. All of the verification spectra were within the control limits except for files B0078CAB and B0078CAA. These files were recorded prior to and at the end of logging run 2. Examinations of spectra indicate that the detector appears to have functioned normally during log run 2, and the spectra are provisionally accepted, subject to further review and analysis. The post-run verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR.

Spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated in EXCEL (source file: G2BNov01.xls), using parameters determined from analysis of calibration data collected in November 2001. Zero reference is the top of the casing. On the basis of observations of the logging engineer and Ledgerwood (1993), the casing configuration was assumed to be one string of 8-in. casing with a thickness of 0.3125 in. to total logged depth. A water correction was applied below 221.9 ft. Dead time corrections were not needed because dead time did not exceed 10.5 percent.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, water correction, or casing correction. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 609 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 1764 keV because it generally exhibited slightly higher net counts. The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for both the man-made and naturally occurring radionuclides.

Results and Interpretations:

^{60}Co and ^{137}Cs, which are man-made radionuclides, were detected in this borehole. ^{60}Co was detected in the interval from 214 to 227.5 ft. ^{60}Co concentrations increase from about 0.2 pCi/g at 214 ft to about 8 pCi/g at the bottom of the hole (227.5-ft log depth). ^{60}Co was detected below the last reported groundwater depth (221.9 ft). ^{137}Cs contamination was detected at low levels near the ground surface and near 214 ft. A zone of ^{137}Cs contamination was detected near the surface (log depth 2.0 through 3.0 ft) with activities ranging from 1.9 to 0.2 pCi/g. At the first station (2.0-ft log depth), ^{137}Cs activities were about 1.9 pCi/g. At log depths 213.5, 214.0, and 214.5 ft, ^{137}Cs activities ranged from 0.3 to 0.8 pCi/g.

In this borehole, recognizable changes in the KUT logs occurred that can be attributed to changes in stratigraphy. Changes of about 5 pCi/g in apparent ^{40}K activities occur at about 12, 66, and 195 ft. In addition, changes in apparent ^{40}K activities of about 3 pCi/g occur at about 91 and 102 ft. The increase in ^{40}K activities at 12 ft probably represents the transition from the coarse-grained sediments of the Hanford H1 to the finer grained sediments of the Hanford H2. About a 0.5-pCi/g increase in ^{232}Th activities occurs in the interval from 168 to 175 ft. The 50-cps increase in total gamma at log depths 168 through 175 ft is attributed to the increase in apparent ^{232}Th and ^{238}U activities in the same interval. In the 200 West Area, a 0.5-pCi/g increase in ^{232}Th and increase in total gamma is characteristic of the Early Palouse Soil; however, the Early Palouse Soil is generally absent in the 200 East Area. At about 160 ft, the apparent decrease in ^{238}U (609 keV), which occurred at the beginning of logging run four when compared to the end of logging run two, can not be explained by a change in tool sensitivity; the verification files (B0080CAB and B0078CAA) indicate that the tool recorded more net counts at the 609-keV photopeak at the beginning of logging run four versus the end of logging run two. This change may be due to the presence of radon.

Gross gamma profiles from Fecht et al. (1977) indicate that significant amounts of gamma-emitting contamination were present below 200 ft as early as May 1959. Fecht et al. (1977) present log runs from 5/5/59, 5/20/63, and 4/24/70. Based upon the increase in gamma at 51 meters (167 ft), these log runs appear to be nearly on depth with one another. This increase in gamma probably corresponds with the 0.5-pCi/g increase in ^{232}Th activities observed in the interval from 168 to 175 ft on the SGLS log. The gamma contamination appears to start at about 197 ft in 1959 versus about 213 ft in the later log runs. Ledgerwood (1993) reported that the depth to water was about 215 ft (relative to ground surface in November 1989). This depth to water (about 213 ft relative to top of casing) corresponds with the deep ^{137}Cs and the top of the ^{60}Co contamination. Because essentially only deep contamination was detected in this borehole, it is speculated that the ^{137}Cs and ^{60}Co detected below 213 ft were transported in the groundwater to this location as the borehole is remote to the nearby major waste disposal sites (216-B-8 Crib and the BY Cribs).

References:

Chamness, M.A. and J.K. Merz, 1993. *Hanford Wells*, PNL-8800, UC-903, Pacific Northwest Laboratory, Richland, Washington.

Fecht, K.R., G.V. Last, and K.R. Price, 1977. *Evaluation of Scintillation Probe Profiles From 200 Area Crib Monitoring Well*s, ARH-ST-156, UC-70, Atlantic Richfield Hanford Company, Richland, Washington.

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection Wells*, WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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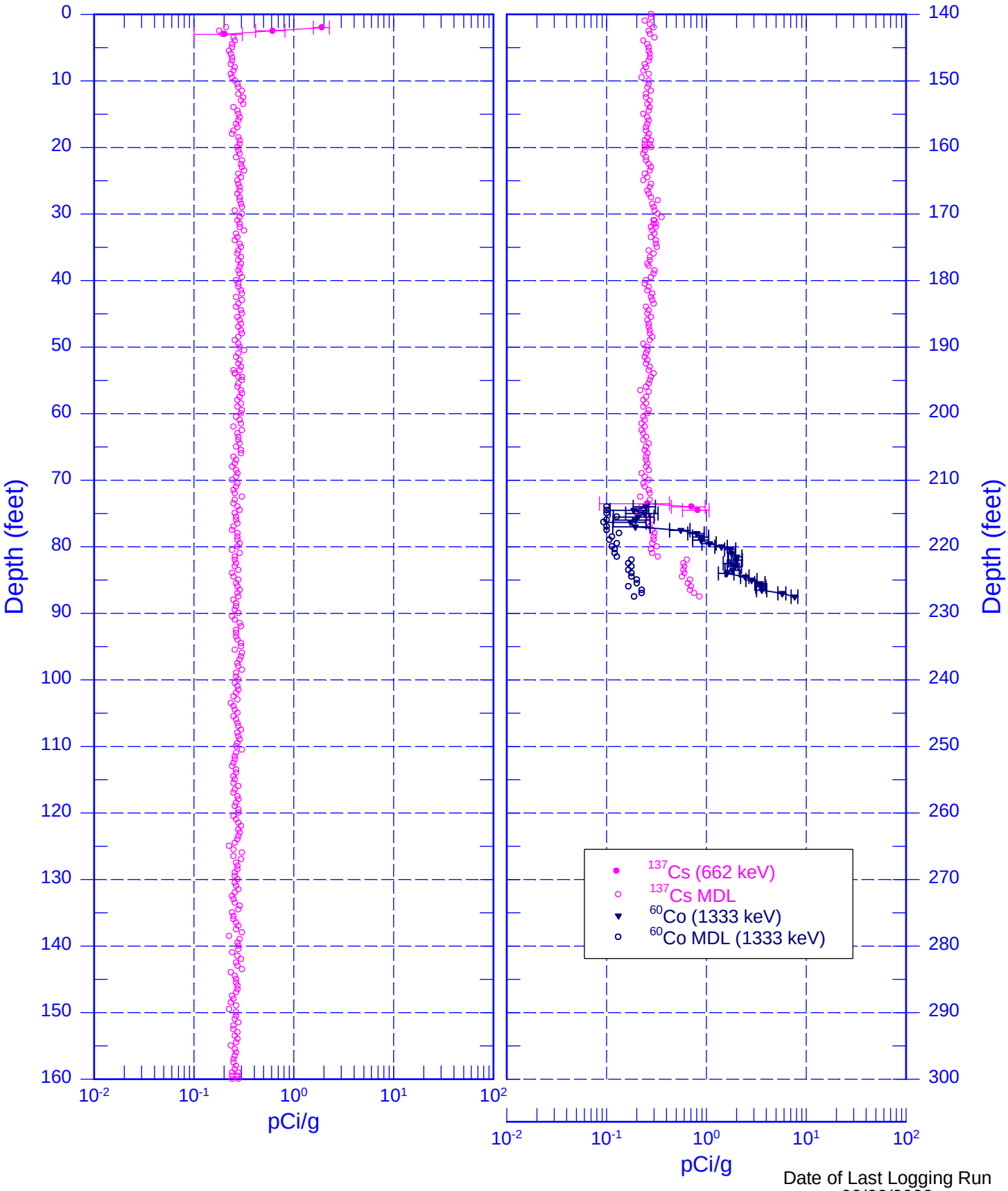
[1] GWL – groundwater level
[2] TOC – top of casing
[3] HWIS – Hanford Well Information System
[4] N/A – not applicable

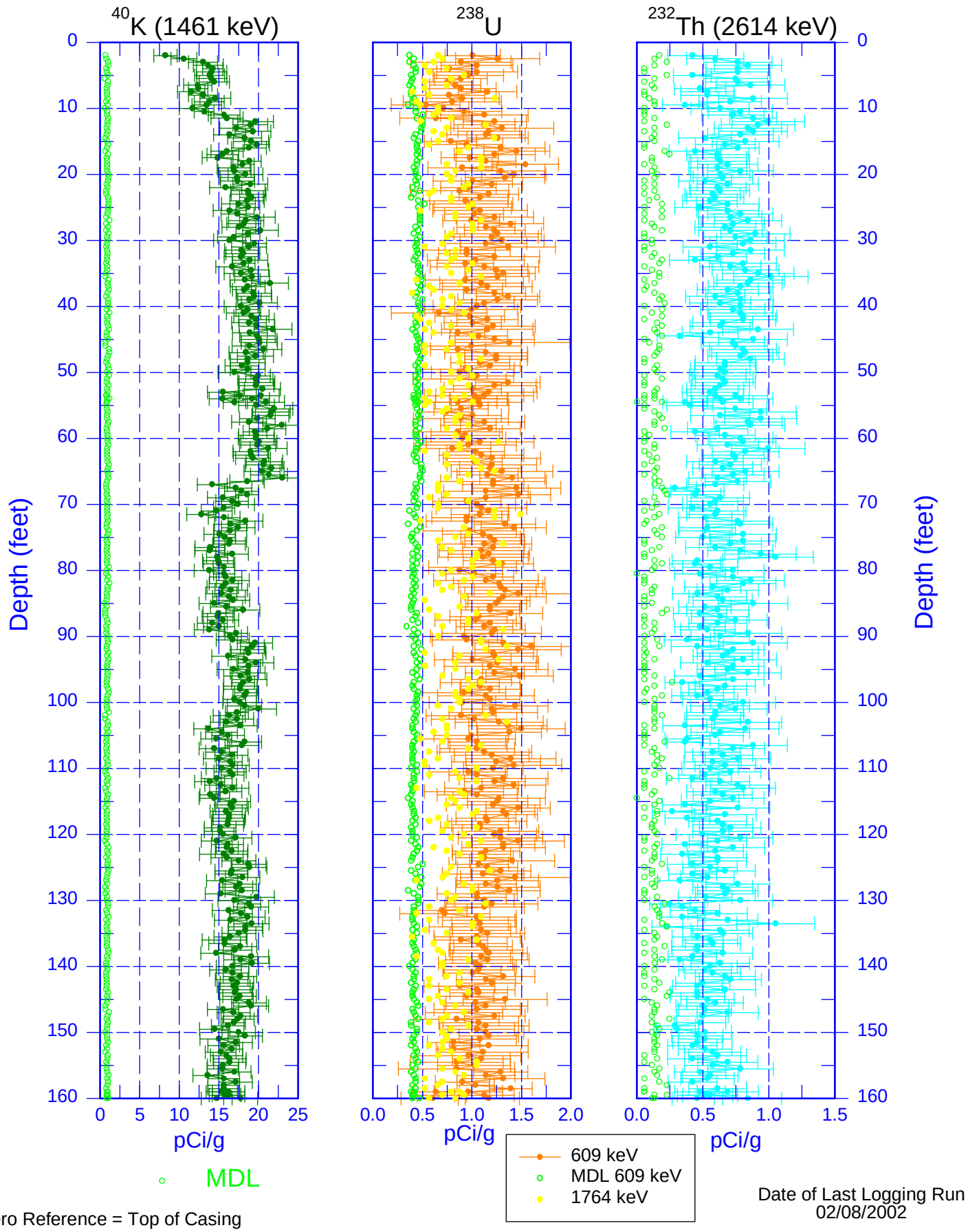
299-E33-11 (A6854)
Man-Made Radionuclides



Zero Reference = Top of Casing

Date of Last Logging Run
02/08/2002

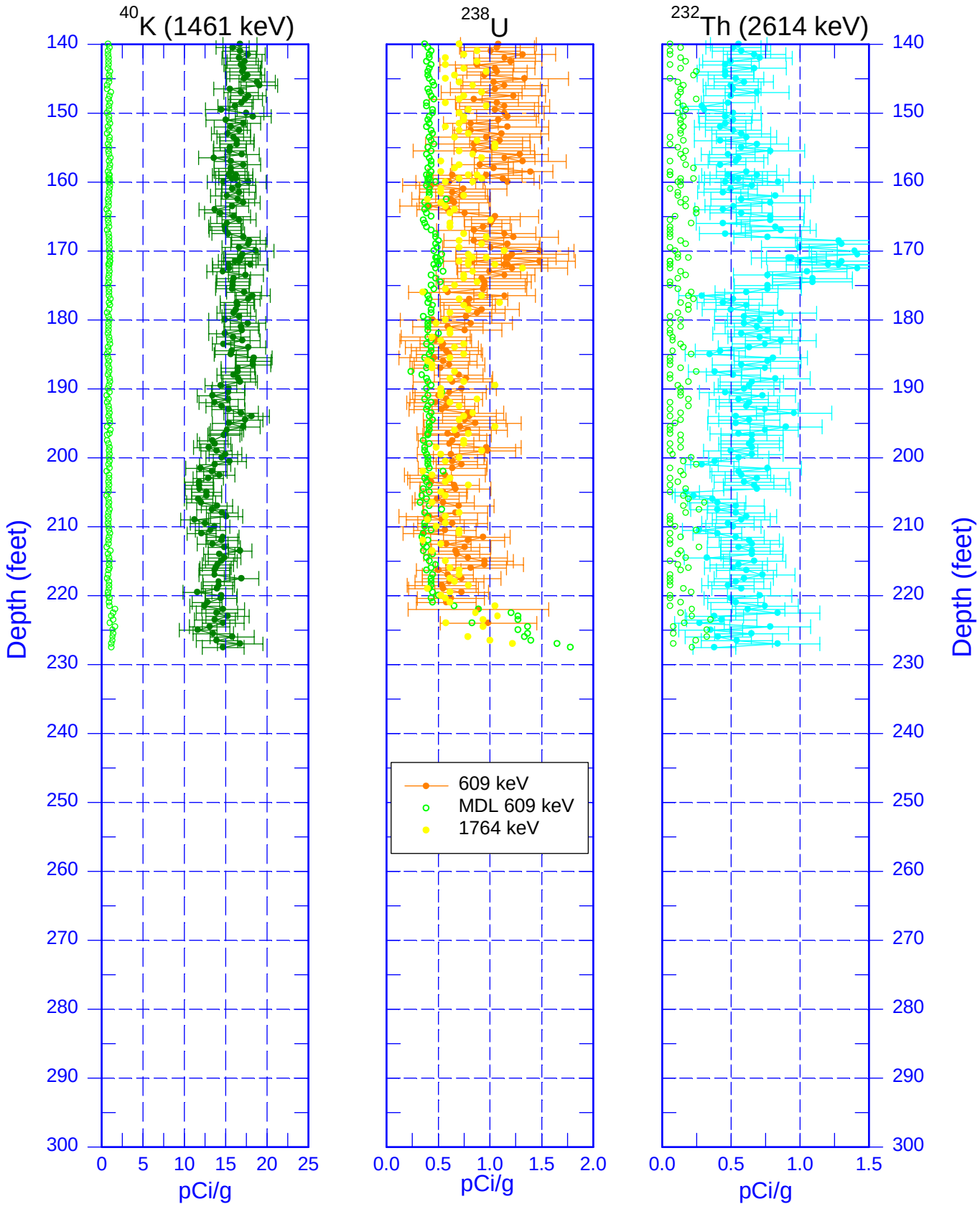
299-E33-11 (A6854)
Natural Gamma Logs



Zero Reference = Top of Casing

Date of Last Logging Run
02/08/2002

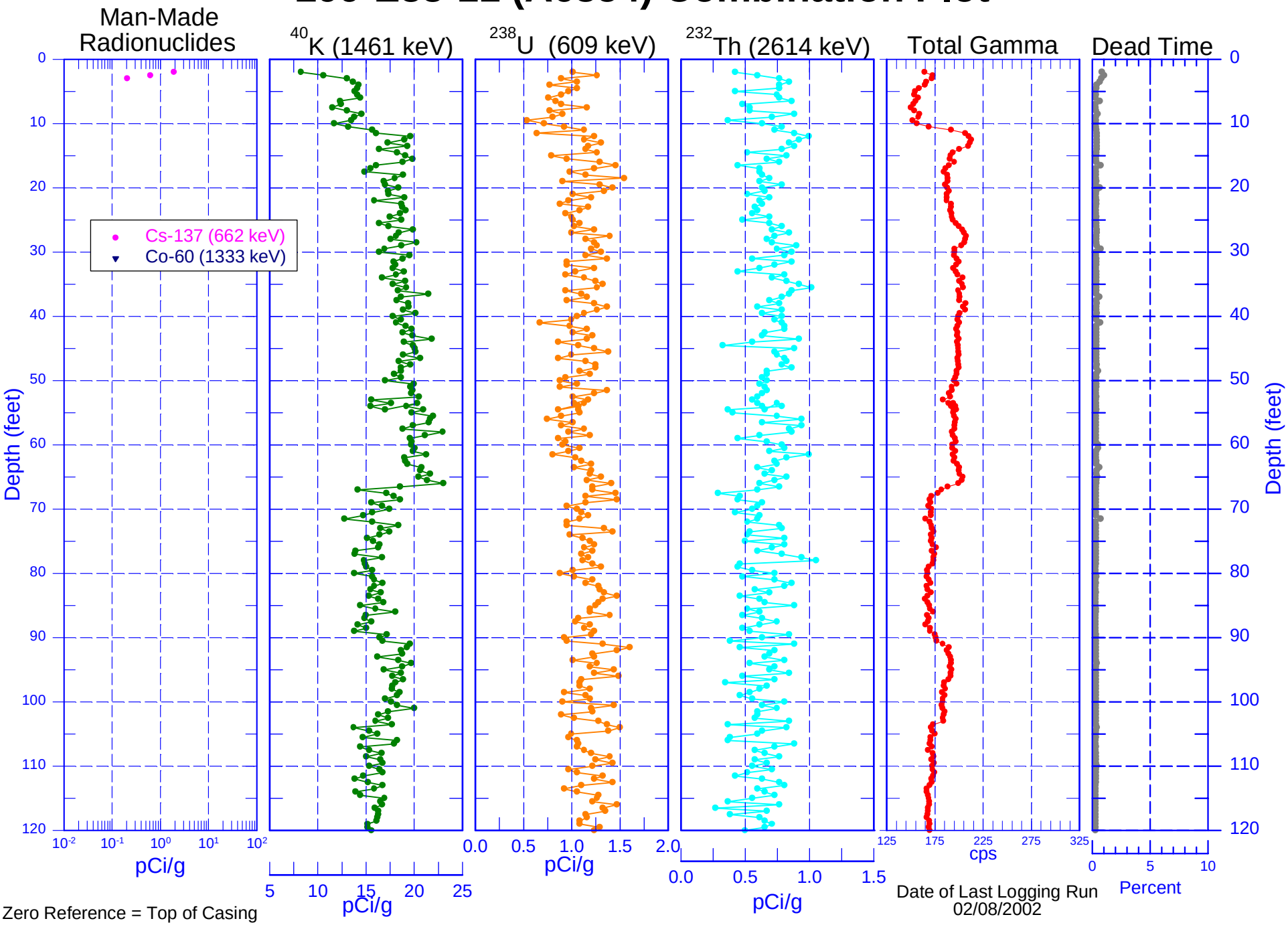
299-E33-11 (A6854)
Natural Gamma Logs



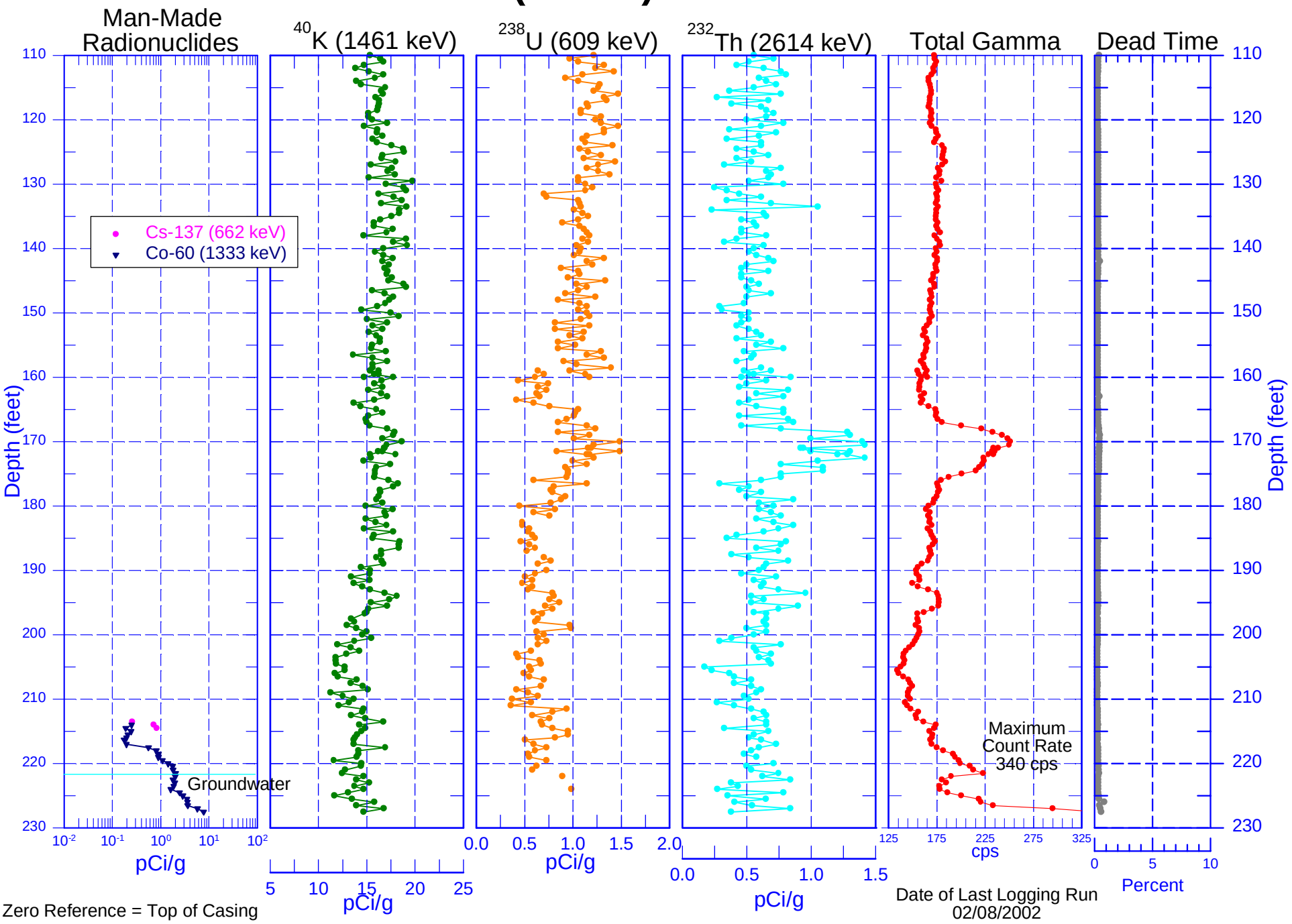
Zero Reference = Top of Casing

Date of Last Logging Run
02/08/2002

299-E33-11 (A6854) Combination Plot

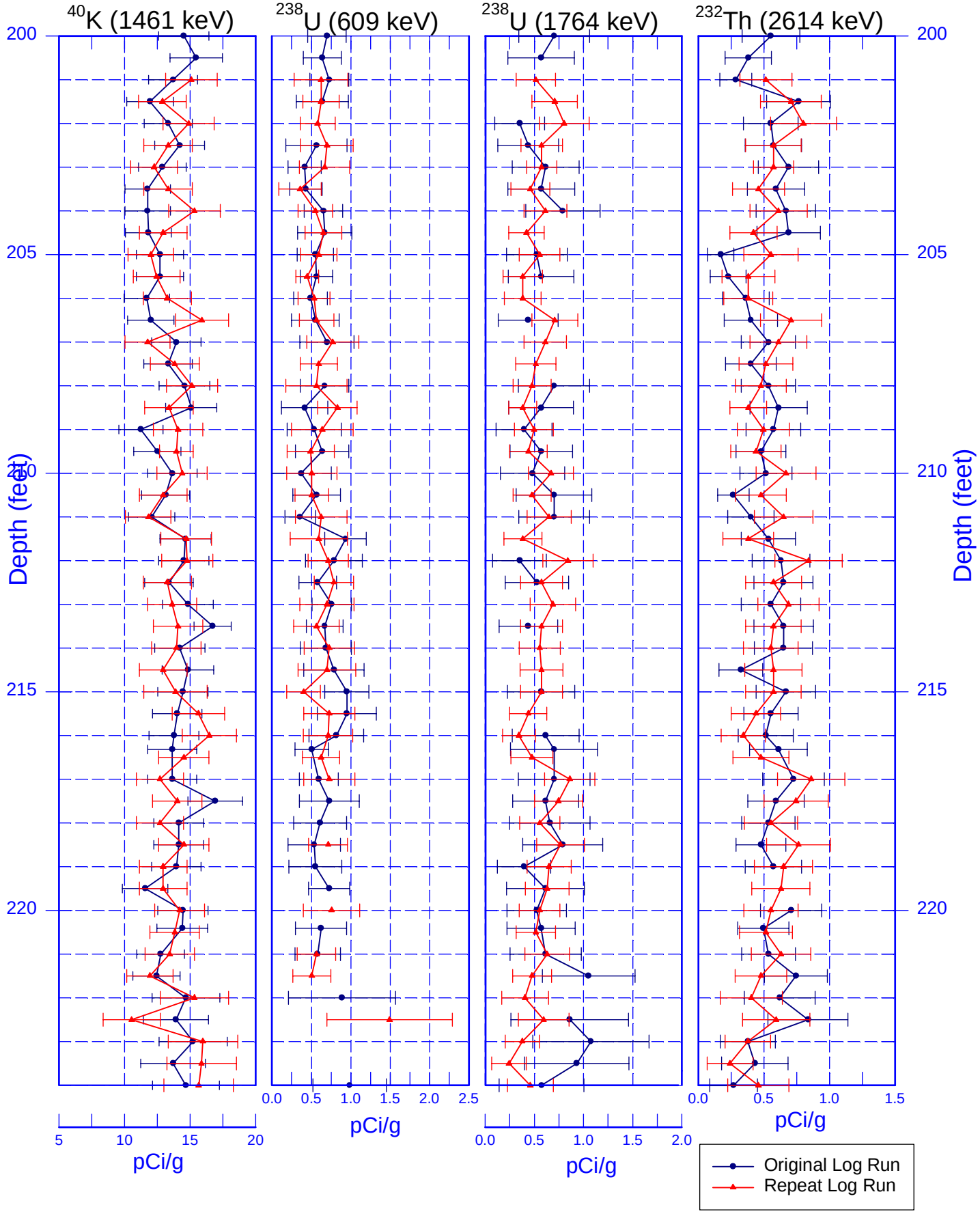


299-E33-11 (A6854) Combination Plot



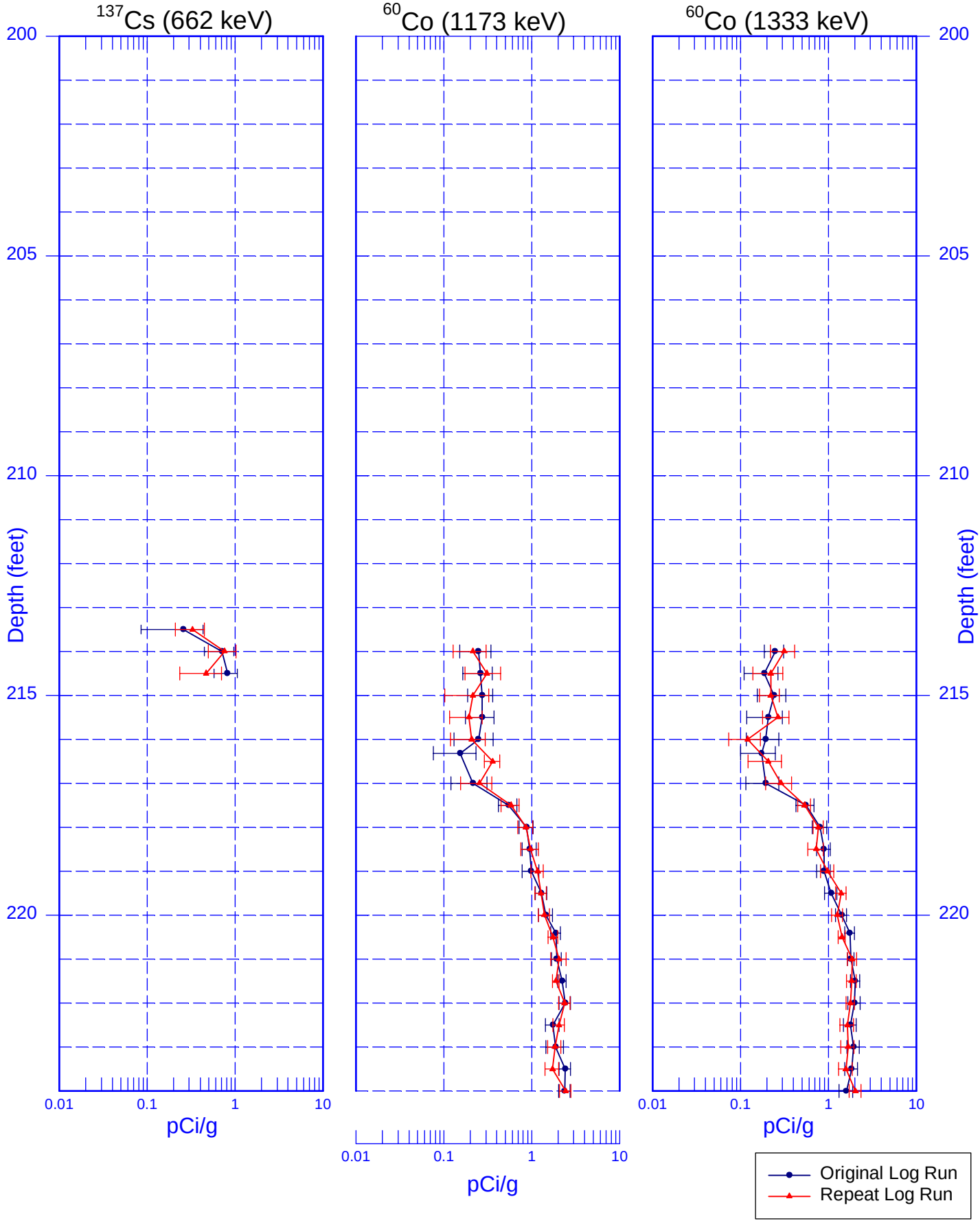
299-E33-11 (A6854)

Rerun of Natural Gamma Logs

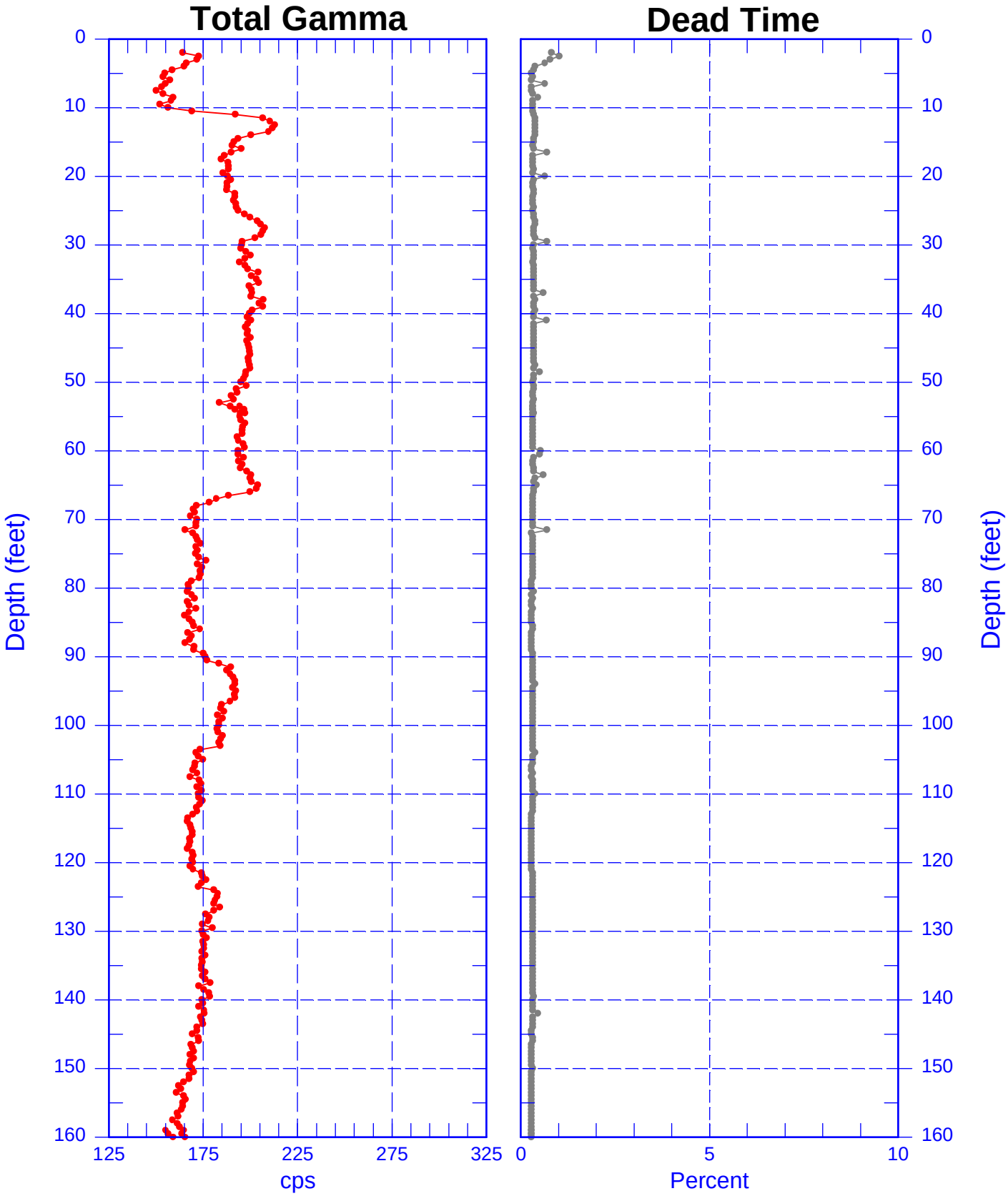


299-E33-11 (A6854)

Rerun of Man-Made Radionuclides (200-224 ft)



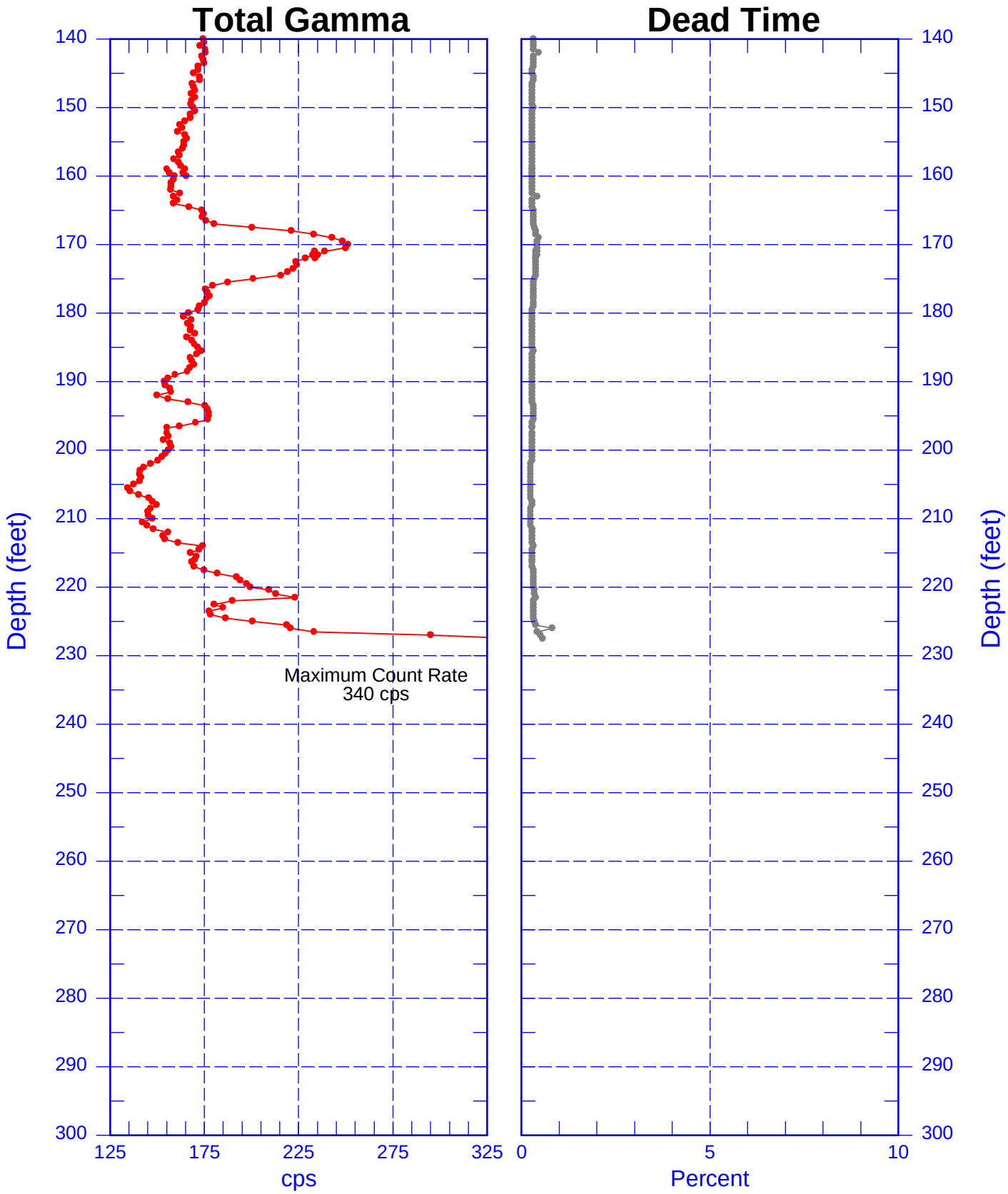
299-E33-11 (A6854)
Total Gamma & Dead Time



Zero Reference = Top of Casing

Date of Last Logging Run
02/08/2002

299-E33-11 (A6854)
Total Gamma & Dead Time



Zero Reference = Top of Casing

Date of Last Logging Run
02/08/2002